

1 In the claims:

2 1. A flex circuit for use in a fuel cell, the flex circuit, comprising:

3 a fuel-side flexible circuit, comprising:

4 a first flex substrate, wherein the first flex substrate comprises

5 openings through which pass liquid fuel,

6 a first porous layer adjacent the first flex substrate, the first porous

7 layer including a first catalyst layer,

8 an anode electrode between the first flex substrate and the first

9 porous layer, and

10 a boundary layer disposed adjacent the first porous layer, the

11 boundary layer preventing cross-over of the liquid fuel;

12 an air/water-side flexible circuit, disposed in parallel with the fuel-side

13 flexible circuit, comprising:

14 a second flex substrate, wherein the second flex substrate comprises

15 openings through which pass water,

16 a second porous layer adjacent the second flex substrate, the second

17 porous layer including a second catalyst layer, and

18 a cathode electrode between the second flex substrate and the

19 second porous layer; and

20 a center section disposed between the first and the second flex circuits,

21 wherein the first and the second flex substrates are conformable to non-planar

22 shapes.

23 2. The flex circuit of claim 1, wherein the center section is a proton exchange

24 membrane.

25 3. The flex circuit of claim 1, wherein the center section is a channel carrying

26 dionized water, the center section further comprising spacers to maintain a

27 separation between the fuel-side flexible circuit and the air/water-side flexible

28 circuit.

29 4. The flex circuit of claim 1, wherein the flex circuit is formed in a shape of a

30 cylinder.

- 1        5.        The flex circuit of claim 4, wherein the liquid fuel is contained within an  
2                interior of  
3        the cylindrical flex circuit.
- 4        6.        The flex circuit of claim 4, wherein the liquid fuel is contained exterior to  
5                the  
6        cylindrical flex circuit.
- 7        7.        The flex circuit of claim 1, wherein the flex circuit is formed in a shape of a  
8                polygon, and wherein the liquid fuel is contained within an interior of the polygon.
- 9        8.        The flex circuit of claim 1, wherein the flex circuit is in a shape of a star  
10                having N  
11        points, and wherein the liquid fuel is contained within an interior of the star-shaped  
12        flex circuit.
- 13        9.        The flex circuit of claim 1, wherein the first porous layer comprises a  
14                plurality  
15        of pores oriented in a vertical direction and approximately parallel to a local plane  
16        defined by the first porous layer, wherein a size one or more of the plurality of the  
17        pores is chosen such that the liquid fuel is transported to near a top vertical limit of  
18        the one or more pores by capillary action.
- 19        10.       The flex circuit of claim 1, wherein the first and the second porous layers  
20        comprise porous metal.
- 21        11.       The flex circuit of claim 10, wherein the metal is chosen from the group  
22        consisting of zinc and silver.
- 23        12.       A flex-based fuel cell, comprising:  
24                a first flexible circuit; comprising:  
25                        a first flexible substrate, and  
26                        a porous metal/catalyst layer, wherein the porous metal/catalyst  
27        layer comprises a plurality of pores oriented to distribute fuel to substantially all of  
28        the first flexible circuit using a capillary action;  
29                a separation section adjacent the first flexible circuit; and

1           a second flexible circuit adjacent the separation circuit, wherein the first  
2           and the second flexible circuits are conformable to a substantially non-planar  
3           shape.

4           13.     The flex-based fuel cell of claim 12, wherein the separation section is a  
5           proton  
6           exchange membrane.

7           14.     The flex-based fuel cell of claim 12, wherein the separation section is a  
8           channel  
9           comprising dionized water.

10          15.     The flex-based fuel cell of claim 12, wherein the substantially non-planar  
11          shape  
12          comprises a cylinder.

13          16.     The flex-based fuel cell of claim 15, wherein an interior of the cylindrical  
14          flex-  
15          based fuel cell comprises liquid fuel.

16          17.     The flex-based fuel cell of claim 16, wherein the liquid fuel is methanol.

17          18.     The flex-based fuel cell of claim 12, further comprising a dry film adhesive  
18          disposed between the first flexible substrate and the second flexible substrate.

19          19.     A flex-based fuel cell, comprising:  
20                 means for converting liquid fuel to protons, comprising:  
21                         means for transporting liquid fuel through the liquid fuel converting  
22                 means, and  
23                         first means for flexibly supporting the liquid fuel converting means;  
24                 means for receiving the protons, comprising:  
25                         means for converting the protons to water vapor, and  
26                         second means for flexibly supporting the proton converting means;  
27          and  
28                 means for exchanging the protons from the liquid fuel converting means to  
29          the proton converting means.

30          20.     The flex-based fuel cell of claim 19, wherein the liquid fuel transporting  
31          means

1 comprises a porous metal layer having means for causing capillary transport of the  
2 liquid fuel within the porous metal layer.

3 21. The flex-based fuel cell of claim 19, wherein the proton exchanging means  
4 comprises a proton exchange membrane.

5 22. The flex-based fuel cell of claim 19, wherein the proton exchanging means  
6 comprises a dionized water channel.

7 23. A method of preparing a flex circuit for a fuel cell, comprising:  
8 patterning a conductive material on flex supporting means having a front  
9 surface and a back surface, wherein the conductive material is patterned on the  
10 front surface;  
11 attaching a layer of porous material to the conductive material;  
12 depositing a layer of catalytic coating on the surface of the porous material;  
13 and  
14 ablating the supporting means from the back surface to make openings so  
15 that the porous material is exposed.

16 24. The method of claim 23, further comprising the step of coating the catalyst  
17 layer  
18 with a thin layer of proton transfer membrane.